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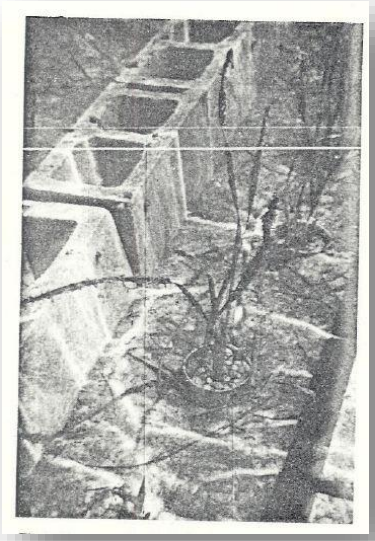
Seagrass Restoration: Comparative analysis at the Julia Tuttle

M.S. Fonseca, Vice President Science, CSA Ocean Sciences Inc.

T. Jordan-Sellers, Senior Biologist, U.S. Army Corps of Engineers, Jacksonville District, Environmental Branch

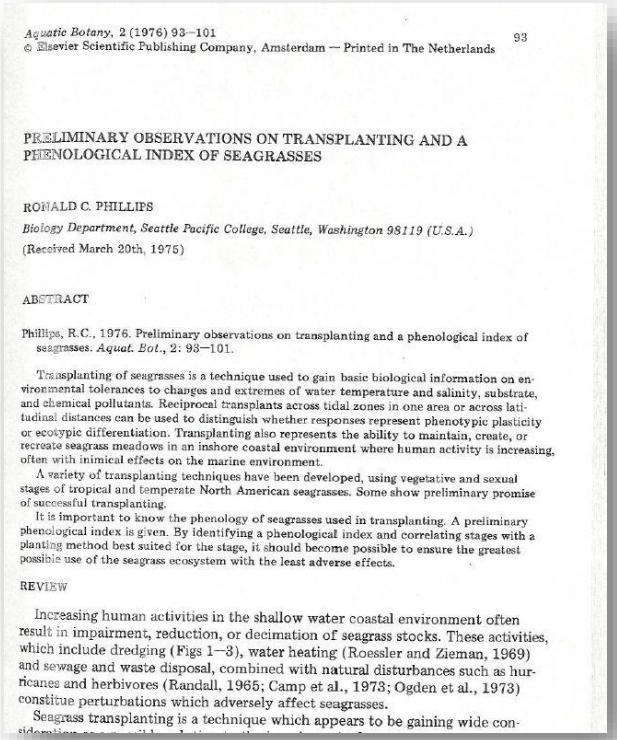
Purposes of seagrass transplanting

- Pilot studies for site suitability
- Actual mitigation
- Common garden experiments (photoadaptation, phenotypic plasticity, species limits)



Phillips 1974

Julia Tuttle 2015



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PRELIMINARY OBSERVATIONS ON TRANSPLANTING AND A PHENOLOGICAL INDEX OF SEAGRASSES

RONALD C. PHILLIPS

Biology Department, Seattle Pacific College, Seattle, Washington 98119 (U.S.A.)

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ABSTRACT

Phillips, R.C., 1976. Preliminary observations on transplanting and a phenological index of seagrasses. *Aquat. Bot.*, 2: 93—101.

Transplanting of seagrasses is a technique used to gain basic biological information on environmental tolerances to changes and extremes of water temperature and salinity, substrate, and chemical pollutants. Reciprocal transplants across tidal zones in one area or across latitudinal distances can be used to distinguish whether responses represent phenotypic plasticity or ecotypic differentiation. Transplanting also represents the ability to maintain, create, or recreate seagrass meadows in an inshore coastal environment where human activity is increasing, often with inimical effects on the marine environment.

A variety of transplanting techniques have been developed, using vegetative and sexual stages of tropical and temperate North American seagrasses. Some show preliminary promise of successful transplanting.

It is important to know the phenology of seagrasses used in transplanting. A preliminary phenological index is given. By identifying a phenological index and correlating stages with a planting method best suited for the stage, it should become possible to ensure the greatest possible use of the seagrass ecosystem with the least adverse effects.

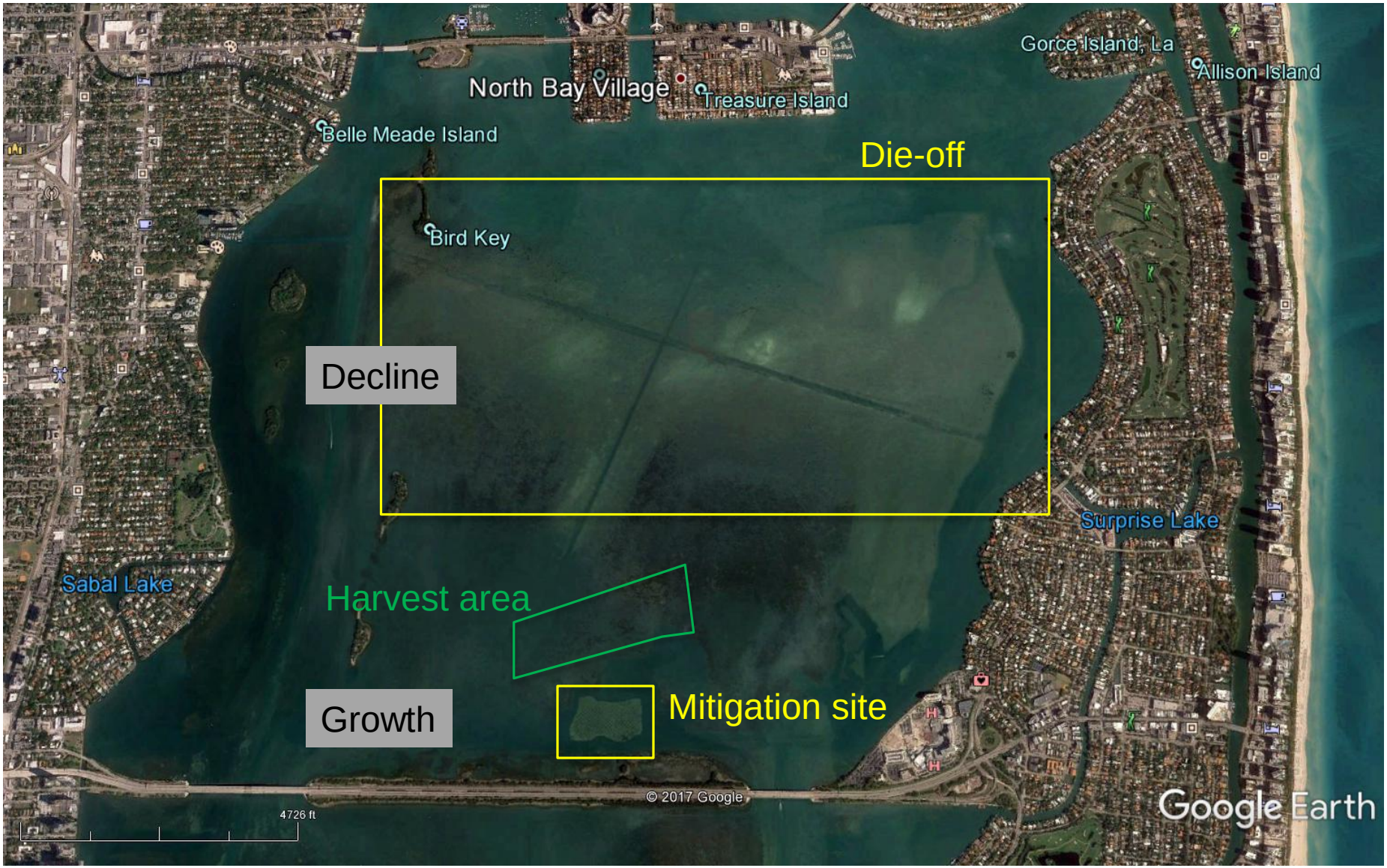
REVIEW

Increasing human activities in the shallow water coastal environment often result in impairment, reduction, or decimation of seagrass stocks. These activities, which include dredging (Figs 1—3), water heating (Roessler and Zieman, 1969) and sewage and waste disposal, combined with natural disturbances such as hurricanes and herbivores (Randall, 1965; Camp et al., 1973; Ogden et al., 1973) constitue perturbations which adversely affect seagrasses.

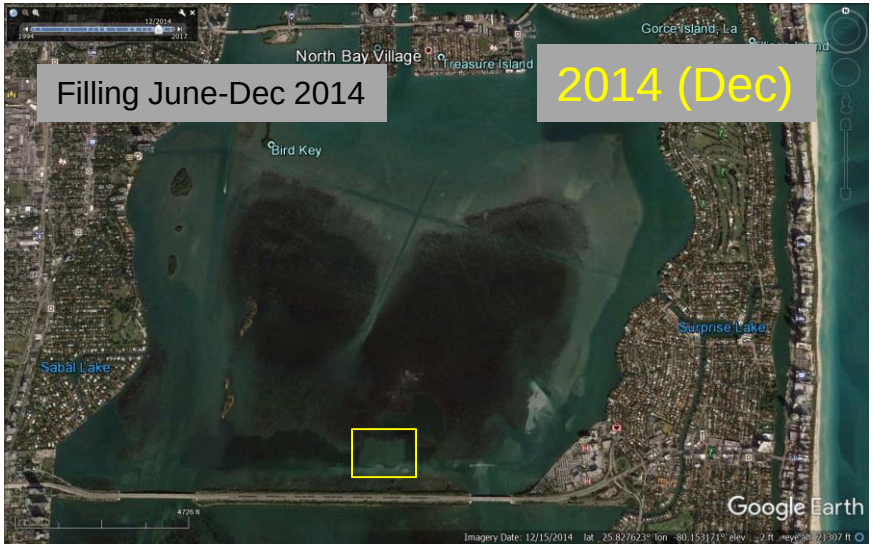
Seagrass transplanting is a technique which appears to be gaining wide con-

Phillips 1976

Comparative Analysis - JT mitigation

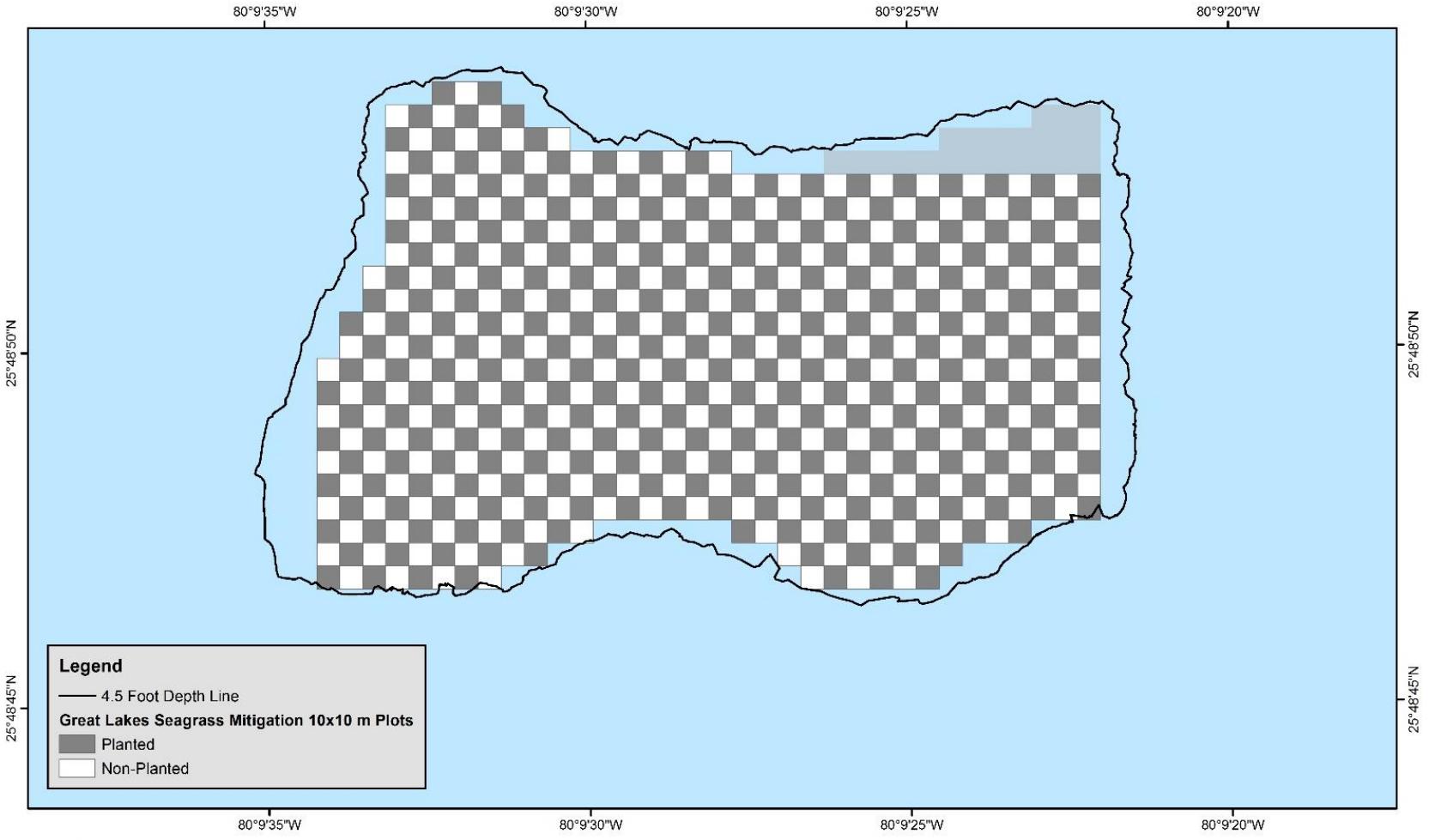


Die-off geography and history

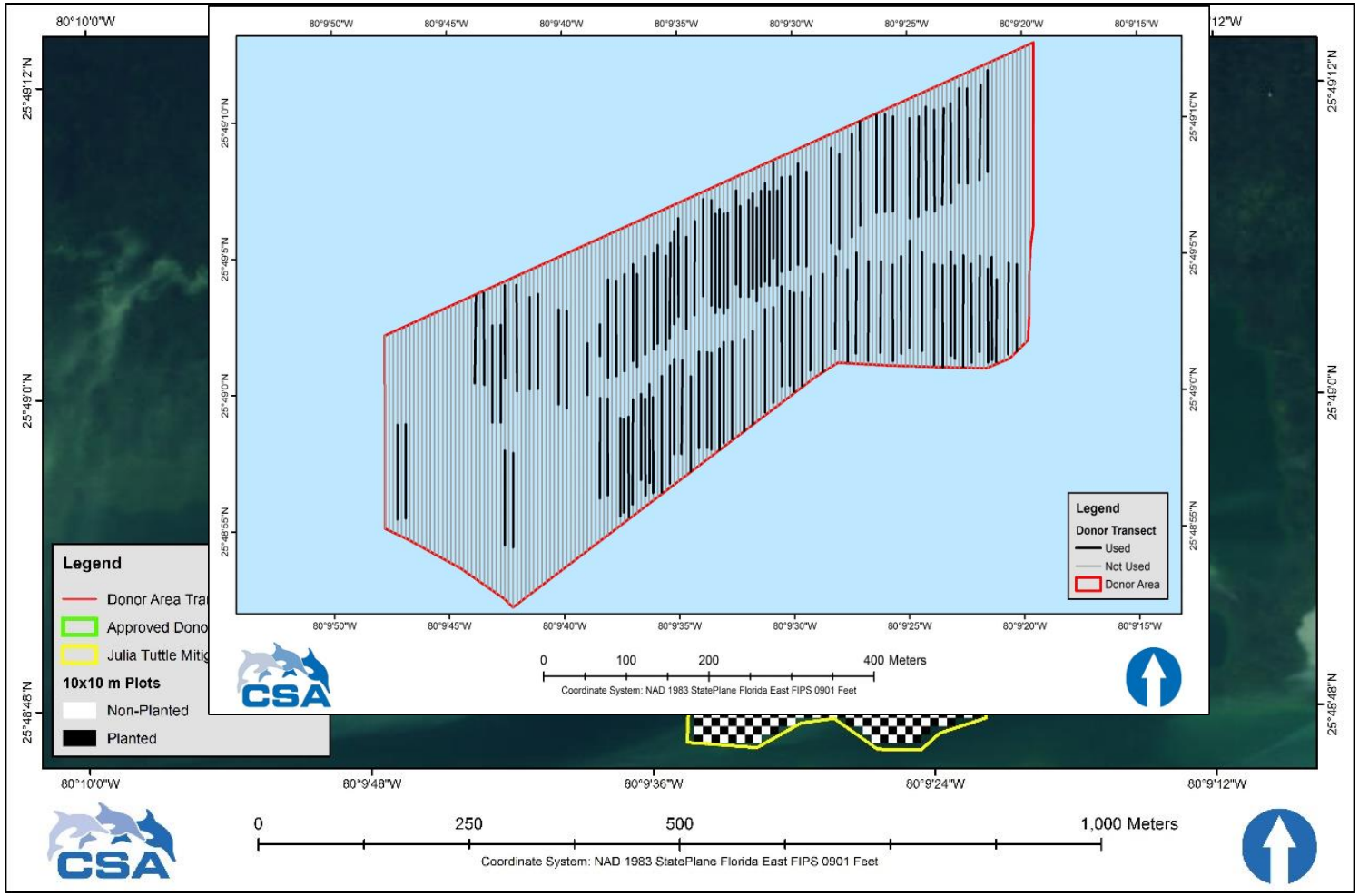


Seagrass planting design

- Checkerboard pattern over ~14 acres
- 290 planted 10 x 10 m plots: 29,000 PU

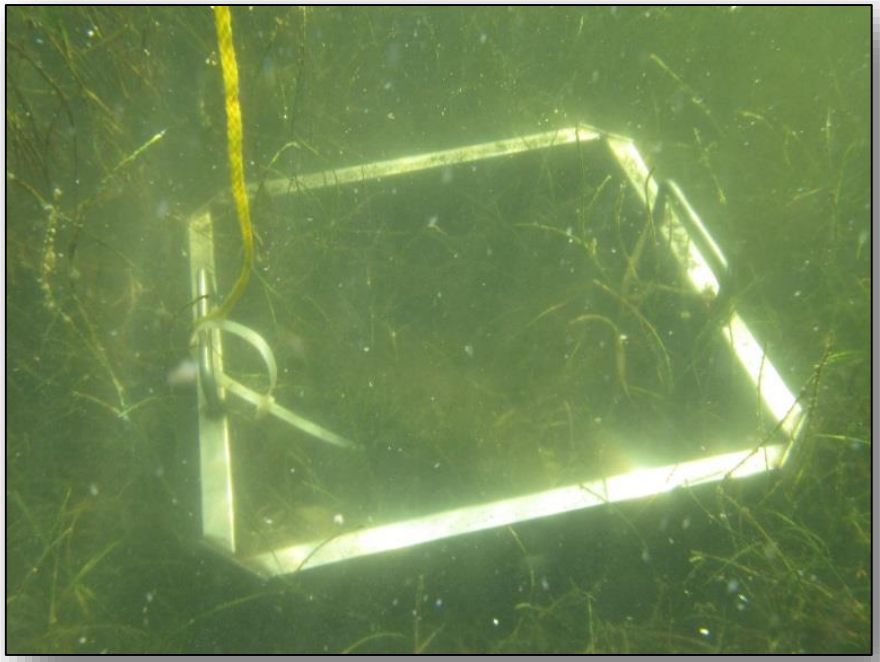


Harvest area



Seagrass harvesting

- 0.25 m^2 harvest plots
- Every 2 m along 100 m transects
- Stored *in situ* in large mesh bags until processed into PU

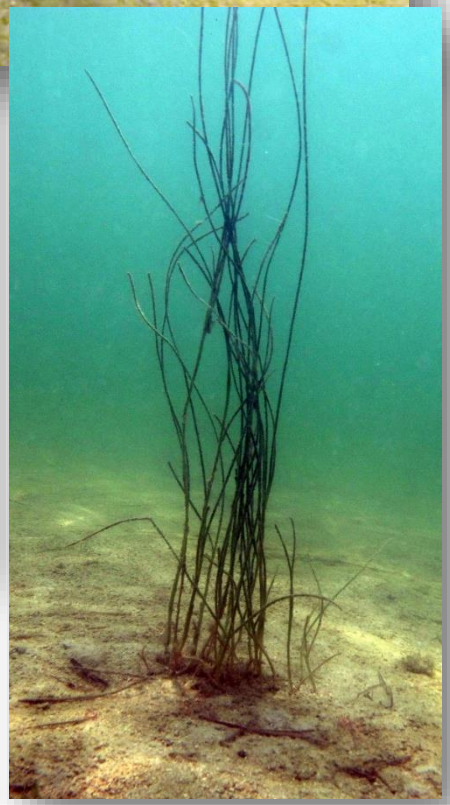


Seagrass PU fabrication and planting

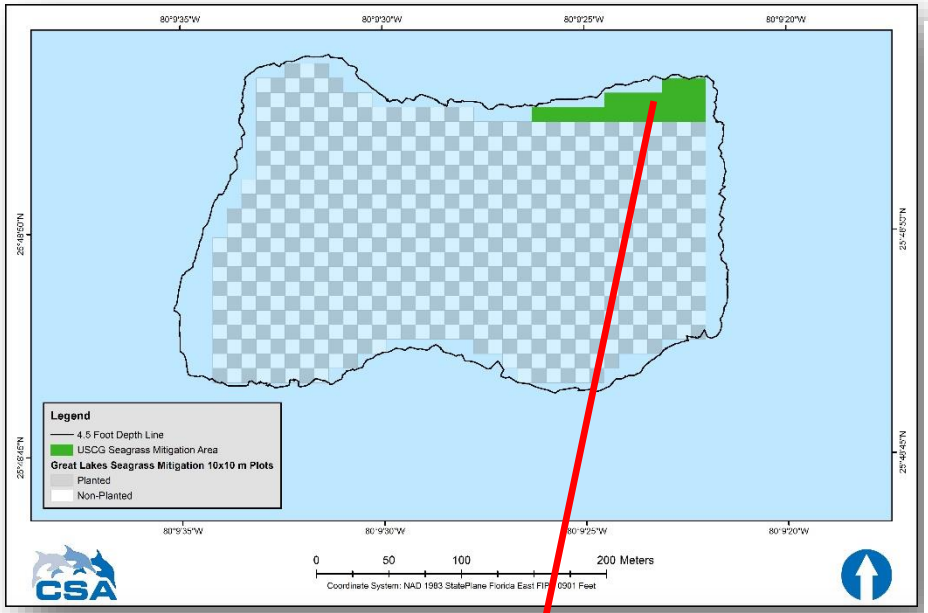
Staple units fabricated in flowing seawater system

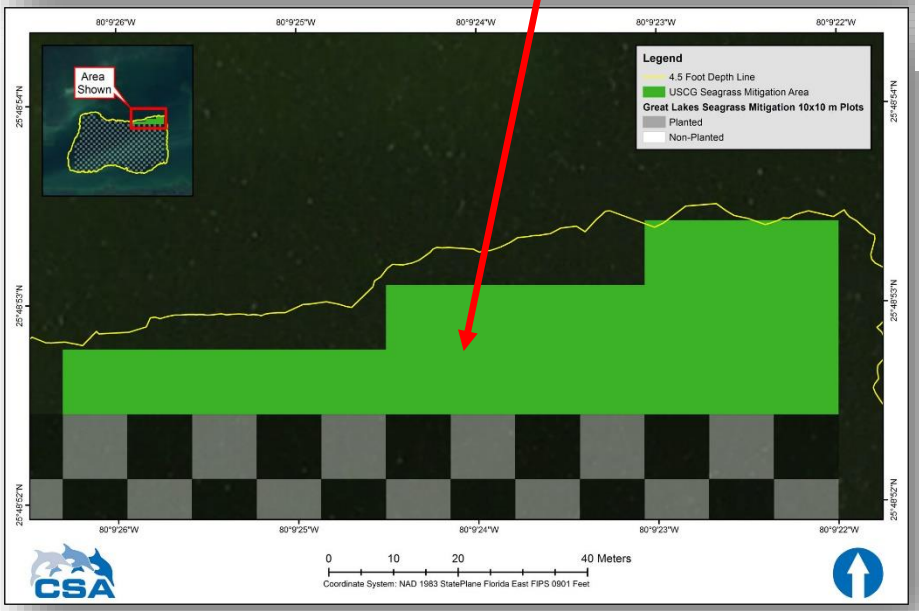
Divers placed one *S. filiforme* PU m^{-2}

Manatees observed eating PUs



USCG mitigation





0.54 acres, conterminous

10 m x 10 m plots planted

(no checkerboard)

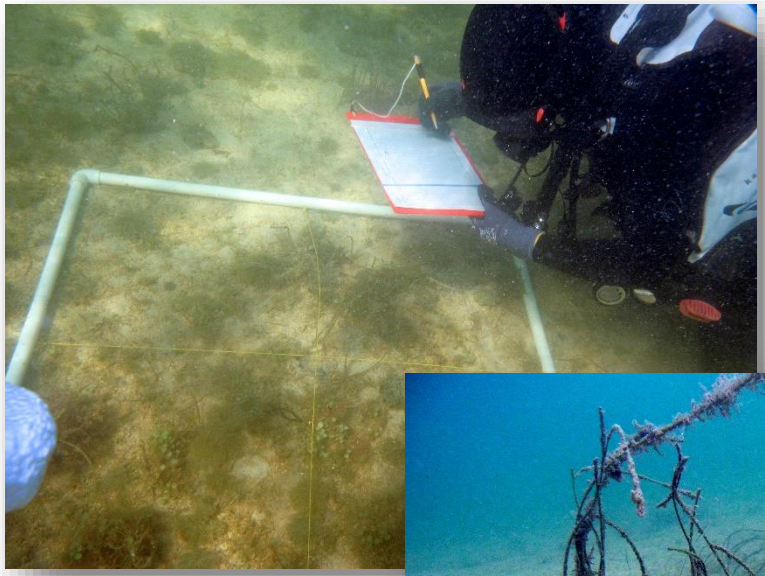
Julia Tuttle – comparative setting

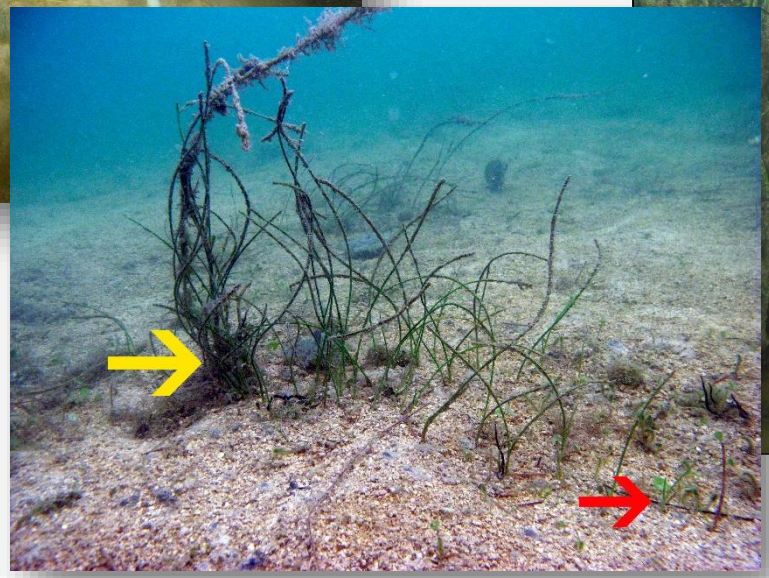
- *Syringodium filiforme* die-off underway
  - Not in proximity to the created habitat
  - Not in area of harvest
- Over 40% fines in surface sediments of natural *S. filiforme* bed
- Less than 5% fines in created habitat

Recent Google Earth Pro image of site

Monitoring

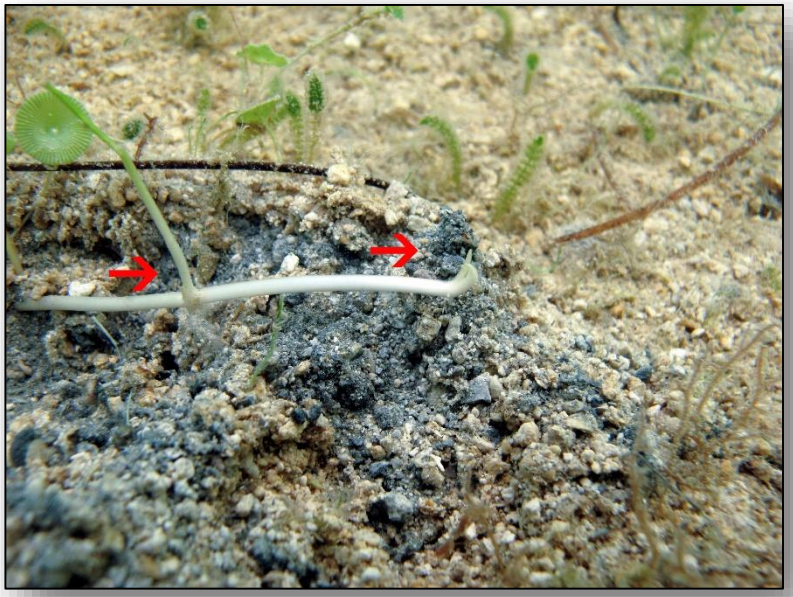
- Survivability survey (~30 day following completion)
- Miami Harbor mitigation: 5 Y by Miami-Dade County consultants
- USCG mitigation: 5 Y by CSA





Initial results ~ 30 DAYS

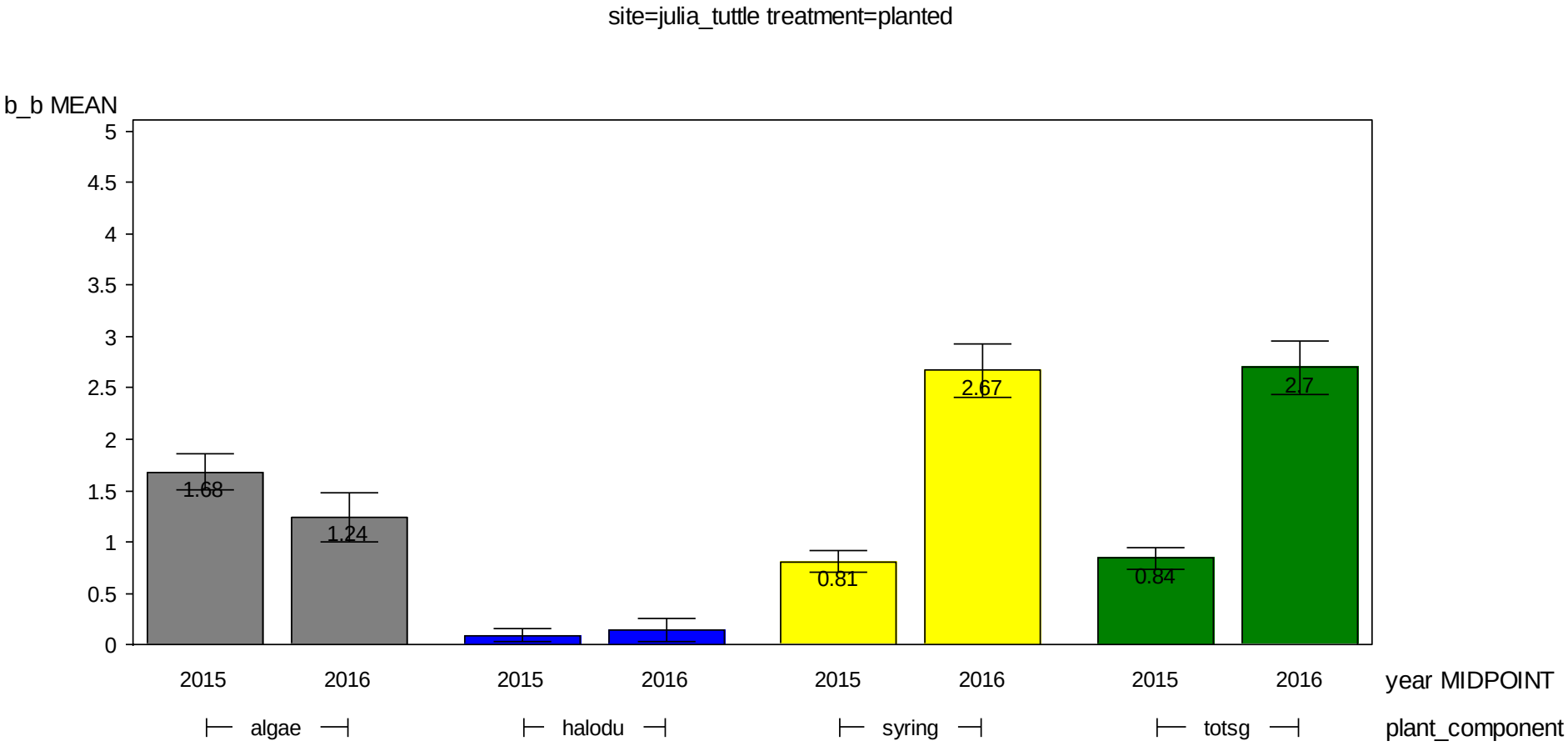
- JT Miami Harbor PUs ~ 98% survival
  - Visible extension above ground
  - Rhizome growth below ground
- USCG PUs ~ 98% survival



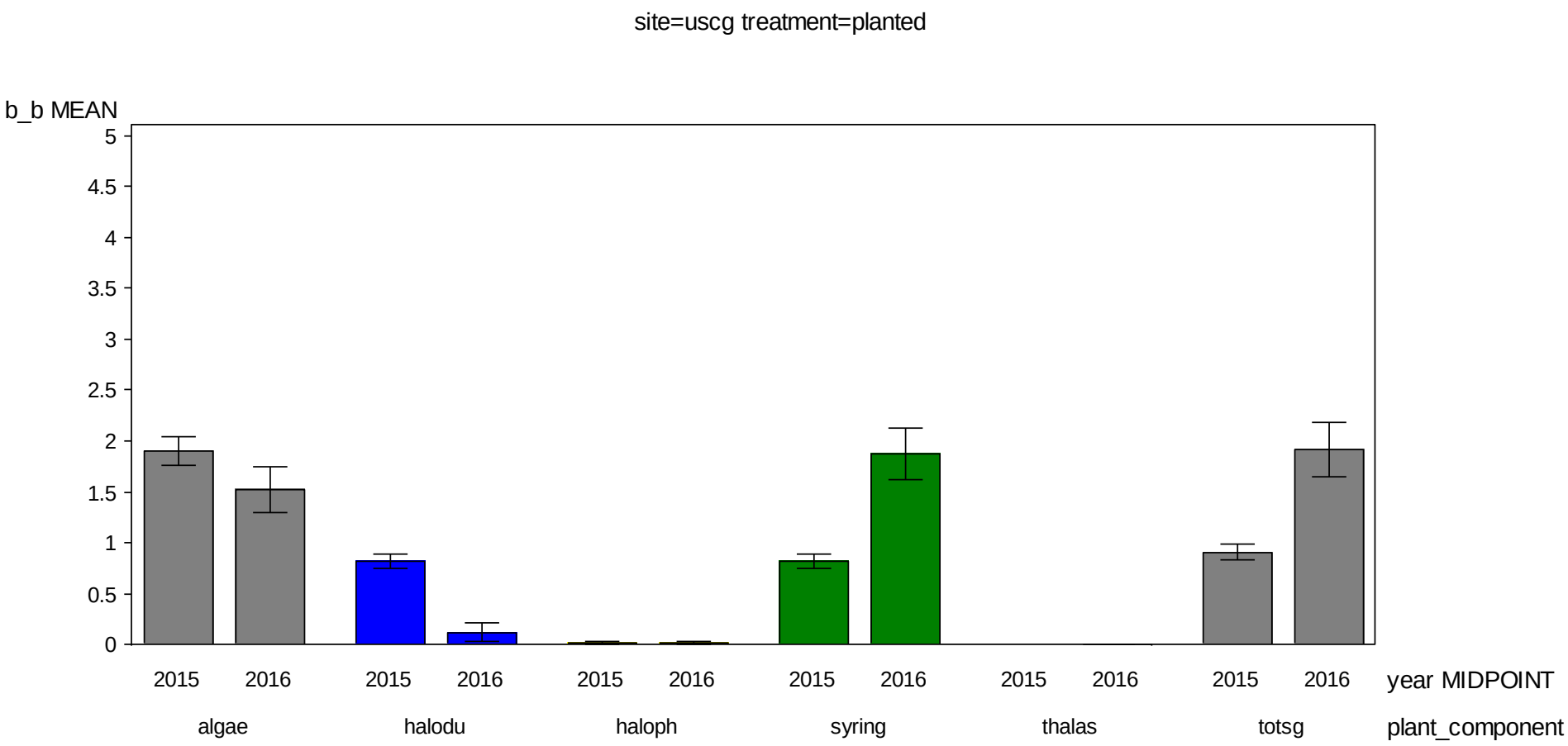
Collateral colonization

- Volunteer seagrass
  - *Halodule wrightii*
  - *Syringodium filiforme*
  - *Halophila decipiens*
  - *Halophila englemanii*
  - *Thalassia testudium*
- Macroalgae
  - *Halimeda*
  - *Batophora*
  - *Caulerpa*

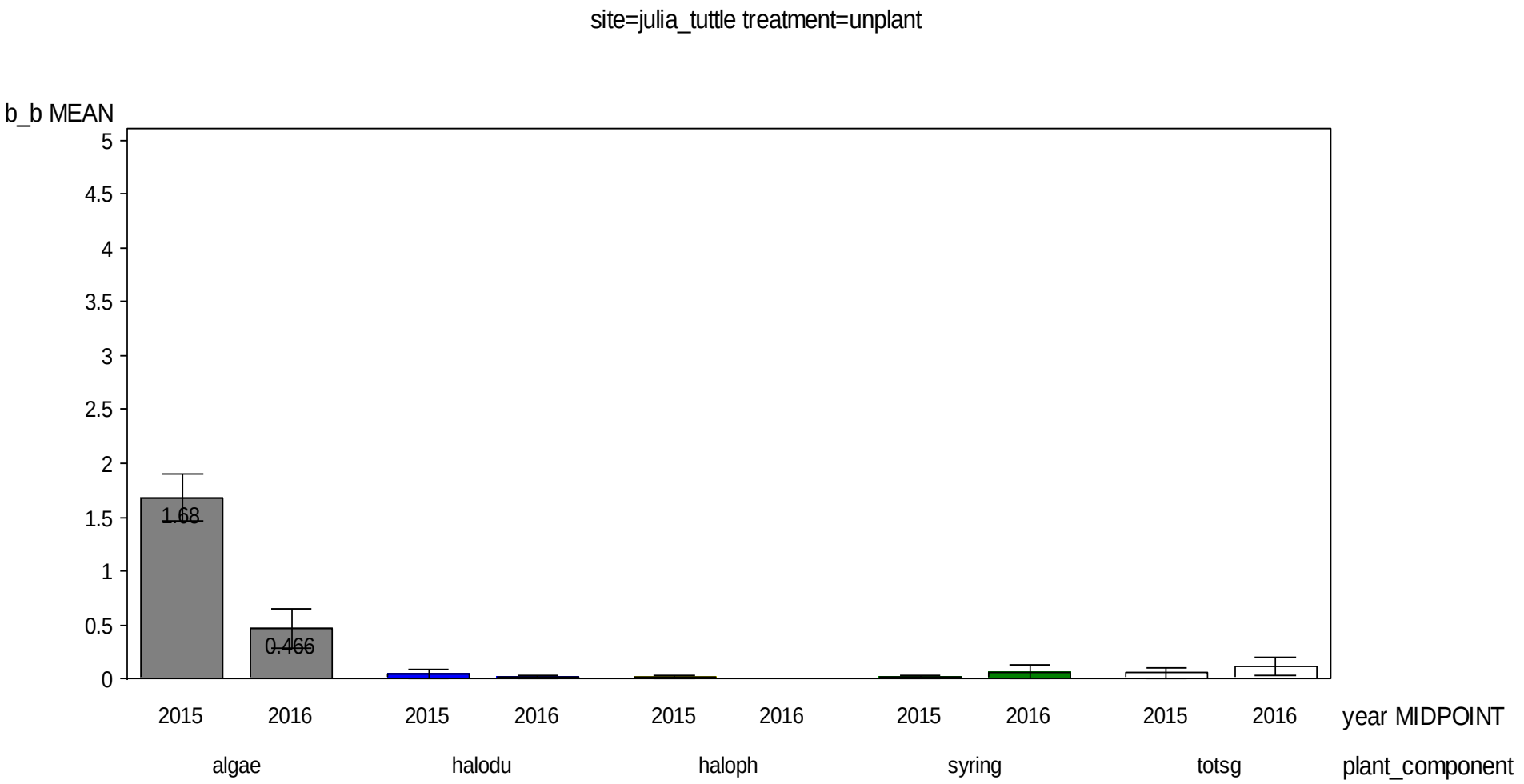
Julia Tuttle – planted area



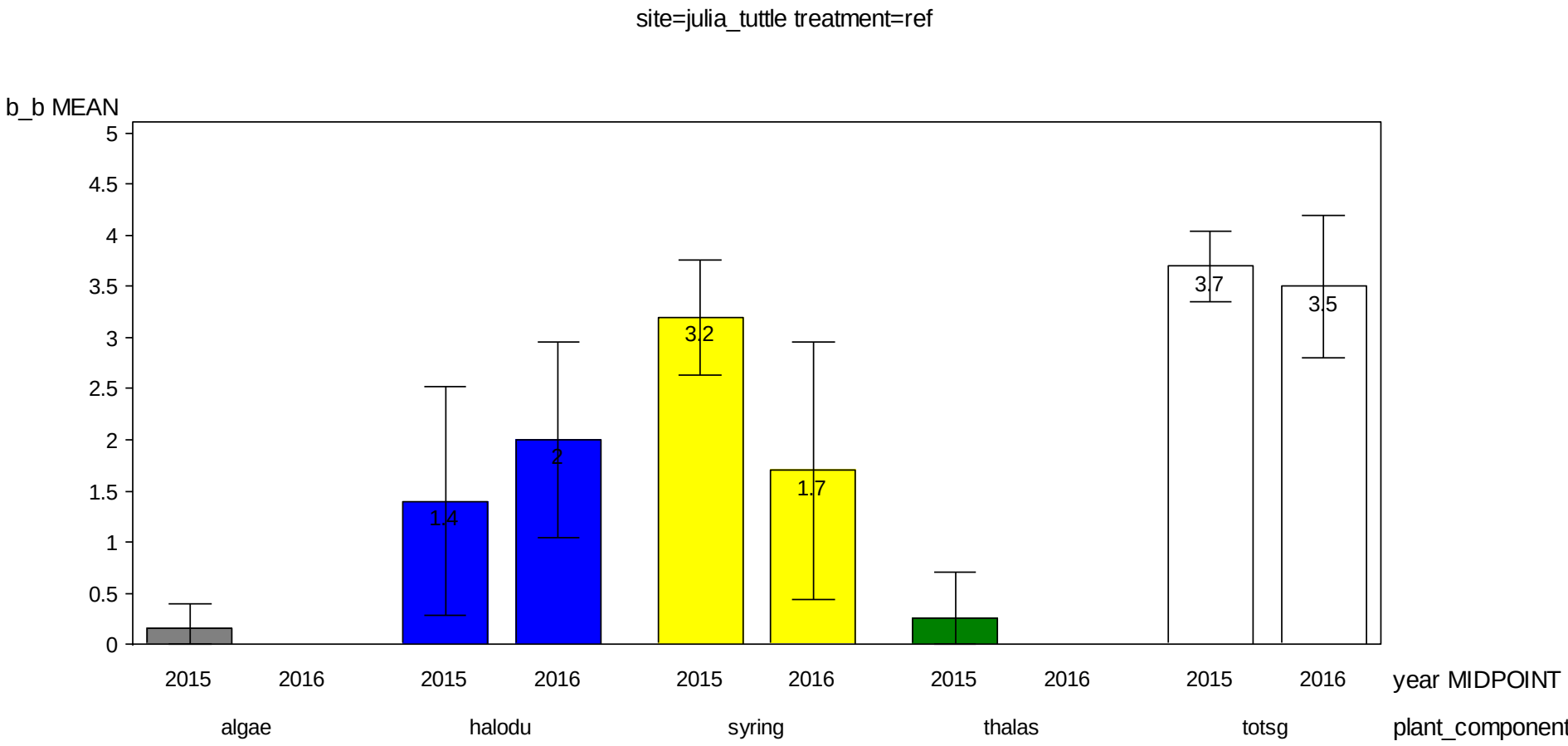
USCG - planted



Julia Tuttle – unplanted portions



Julia Tuttle – adjacent natural reference



Conclusions

Take-aways

- Previous die-off starts, stops and recovery
- This die-off began before JT seagrass mitigation project (JTSMP) filling
- Die-off began at points distant from JTSMP
- Die-off initiation not associated with JTSMP donor beds
- JTSMP ~5% fines / JT natural seagrass area ~ 40% fines
- JTSMP seagrass thriving
- Reference sites showing decline ~ 2016 as die-off spreads?
- JTSMP provides a unique opportunity for comparative analysis?

Questions?